

CLAIMS

1. High yield ratio high-strength thin steel sheet superior in weldability and ductility, characterized by; being comprised of steel containing, by mass%,
- 5 C: over 0.030 to less than 0.10%,
Si: 0.30 to 0.80%,
Mn: 1.7 to 3.2%,
P: 0.001 to 0.02%,
S: 0.0001 to 0.006%,
10 Al: 0.060% or less,
N: 0.0001 to 0.0070%,
containing further
Ti: 0.01 to 0.055%,
Nb: 0.012 to 0.055%,
15 Mo: 0.07 to 0.55%,
B: 0.0005 to 0.0040%, and
simultaneously satisfying
 $1.1 \leq 14 \times \text{Ti}(\%) + 20 \times \text{Nb}(\%) + 3 \times \text{Mo}(\%) + 300 \times \text{B}(\%) \leq 3.7$,
the balance comprised of iron and unavoidable impurities,
20 and
having a yield ratio of 0.64 to less than 0.92,
a TSxEl of 3320 or more, an $\text{YR} \times \text{TS} \times \text{El}^{1/2}$ of 2320 or more,
and a maximum tensile strength (TS) of 780 MPa or more.
2. High yield ratio high-strength thin steel sheet superior in weldability and ductility as set forth in
25 claim 1, characterized by further containing, by mass%,
one or two of
Cr: 0.01 to 1.5%
Ni: 0.01 to 2.0%,
30 Cu: 0.001 to 2.0%,
Co: 0.01 to 1%,
W: 0.01 to 0.3%.
3. High yield ratio high-strength hot-rolled steel sheet superior in weldability and ductility as set forth
35 in claim 1 or 2, characterized in that said yield ratio
is 0.68 to less than 0.92 and in that an X-ray intensity
ratio of a {110} plane parallel to the sheet surface at

1/8 the thickness of the steel sheet is 1.0 or more.

4. High yield ratio high-strength cold-rolled steel sheet superior in weldability and ductility as set forth in claim 1 or 2, characterized in that said yield ratio is 0.64 to less than 0.90 and in that an X-ray intensity ratio of a {110} plane parallel to the sheet surface at 1/8 the thickness of the steel sheet is less than 1.0.

5. High yield ratio high-strength hot-dip galvanized steel sheet superior in weldability and ductility, characterized by comprising hot-rolled steel sheet comprised of the chemical components described in claim 3 and hot-dip galvanized.

6. High yield ratio high-strength hot-dip galvanized steel sheet superior in weldability and ductility, characterized by comprising hot-rolled steel sheet comprised of the chemical components described in claim 3, hot-dip galvanized, and alloyed.

7. High yield ratio high-strength hot-dip galvanized steel sheet superior in weldability and ductility, characterized by comprising cold-rolled steel sheet comprised of the chemical components described in claim 4 and hot-dip galvanized.

8. High yield ratio high-strength hot-dip galvanized steel sheet superior in weldability and ductility, characterized by comprising cold-rolled steel sheet comprised of the chemical components described in claim 4, hot-dip galvanized, and alloyed.

9. A method of production of high yield ratio high-strength hot-dip galvanized hot-rolled steel sheet superior in weldability and ductility, characterized by; heating a cast slab comprised of the chemical components described in claim 3 to 1160°C or more directly or after once cooling,

hot-rolling it ending at the A_{r3} transformation temperature or more, then cooling the sheet from the end of hot-

rolling to 650°C by an average cooling rate of 25 to 70°C/sec and

coiling it at 700°C or less in temperature.

- 5 10. A method of production of high yield ratio high-strength hot-dip galvanized hot-rolled steel sheet superior in weldability and ductility, characterized by;
- heating a cast slab comprised of the chemical components described in claim 5 to 1160°C or more directly or after once cooling,
- 10 hot-rolling it ending at the A_{r3} transformation temperature or more, cooling the sheet from the end of hot-rolling to 650°C by an average cooling rate of 25 to 70°C/sec,
- 15 coiling it at 700°C or less in temperature, then
- running it through a hot-dip galvanizing line during which making the maximum heating temperature 500°C to 950°C,
- 20 cooling it to (zinc-coating bath temperature-40)°C to (zinc-coating bath temperature+50)°C, then
- dipping it in a zinc-coating bath and giving it a skin-pass of a reduction rate
- 25 of 0.1% or more.

11. A method of production of high yield ratio high-strength hot-dip galvanized hot-rolled steel sheet superior in weldability and ductility, characterized by;
- heating a cast slab comprised of the chemical components described in claim 6 to 1160°C or more directly or after cooling once,
- 30 hot-rolling it ending at the A_{r3} transformation temperature or more, cooling the sheet from the end of hot-
- 35 rolling to 650°C by an average cooling rate of 25 to

70°C/sec,

coiling it at 700°C or less in temperature,

then

running it through a hot-dip galvanizing

5 line during which making the maximum heating temperature
500°C to 950°C,

cooling it to (zinc-coating bath

temperature-40)°C to (zinc-coating bath temperature+50)°C,
then

10 dipping it in a zinc-coating bath, then

alloying it at 480°C or more in temperature

and

giving a skin-pass of a reduction rate of

0.1% or more.

15 12. A method of production of high yield ratio
high-strength cold-rolled steel sheet superior in
weldability and ductility, characterized by;

heating a cast slab comprised of the

chemical components described in claim 4 to 1160°C or more
20 directly or after once cooling,

hot-rolling it ending at Ar_3 transformation
temperature or more,

cooling the sheet from the end of hot-
rolling to 650°C by an average cooling rate of 25 to

25 70°C/sec,

coiling it at 750°C or less in temperature,

pickling it, then

cold-rolling it at a reduction rate of 30
to 80%,

30 running it through a continuous annealing
line during which making the average heating rate until
700°C 10 to 30°C/sec and making the maximum heating
temperature 750°C to 950°C,

cooling in the cooling process after
35 heating by an average cooling rate in the range of 500 to

600°C of 5°C/sec or more, then

giving it a skin-pass of a reduction rate of 0.1% or more.

13. A method of production of high yield ratio high-strength hot-dip galvanized steel sheet superior in weldability and ductility, characterized by;

heating a cast slab comprised of the chemical components described in claim 7 to 1160°C or more directly or after cooling once,

hot-rolling it ending at the A_{r3} transformation temperature or more,

cooling the sheet from the end of hot-rolling to 650°C by an average cooling rate of 25 to 70°C/sec,

coiling it at 750°C or less in temperature, pickling it, then

cold-rolling it by a reduction rate of 30 to 80%,

running it through a hot-dip galvanizing line during which making the average heating rate up to 700°C 10 to 30°C/sec and making the maximum heating temperature 750°C to 950°C,

cooling it in the cooling process after heating by an average cooling rate in the range of 500 to 600°C of 5°C/sec or more,

cooling it to (zinc-coating bath temperature-40)°C to (zinc-coating bath temperature+50)°C, dipping it in a zinc-coating bath, and

giving it a skin-pass of a reduction rate of 0.1% or more.

14. A method of production of high yield ratio high-strength hot-dip galvanized steel sheet superior in weldability and ductility, characterized by;

heating a cast slab comprised of the chemical components described in claim 8 to 1160°C or more

directly or after cooling once,
hot-rolling it ending at the A_{r3}
transformation temperature or more,
cooling the sheet from the end of hot-
5 rolling to 650°C by a cooling rate of 25 to 70°C/sec ,
coiling at 750°C in temperature,
pickling it, then
cold-rolling it by a reduction rate of 30
to 80%,
10 running it through a hot-dip galvanizing
line during which making the average heating rate up to
 700°C 10 to 30°C/sec and making the maximum heating
temperature 750°C to 950°C ,
cooling it in the cooling process after
15 heating by an average cooling in the range of 500 to 600°C
of 5°C/sec or more,
cooling it to (zinc-coating bath
temperature- 40°C) to (zinc-coating bath temperature+ 50°C),
dipping it in a zinc-coating bath, then
20 alloying it at 480°C or more in
temperature, and
giving a skin-pass of a reduction rate of
0.1% or more.